

PATENT
0630-2009PUS1

IN THE U.S. PATENT AND TRADEMARK OFFICE

In Re Application of

Seok-Keun KOH et al.

Before the Board of Appeals

Appeal No.

Appl. No.: 09/509,725

Group: 1753

Filed: March 29, 2000

Examiner: K. MAYEKAR

Conf. No.: 9859

For: PLASMA POLYMERIZATION ON SURFACE OF MATERIAL

APPEAL BRIEF ON BEHALF OF APPELLANTS UNDER
37 C.F.R. §41.37



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MS APPEAL BRIEF - PATENTS
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MS APPEAL BRIEF- PATENTS

Commissioner for Patents

May 11, 2006

P.O. Box 1450

Alexandria, VA 22313-1450

Dear Sir:

This is an Appeal from the Rejection of August 19, 2005 of the rejection of claims 1, 20, 21, 23-26, 28, 29, 33 and 34 in the above-identified application.

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I. REAL PARTY IN INTEREST

As evidenced by the Assignment filed March 29, 2000, and recorded at Reel 010801, Frames 0042-0043 the Real Party In Interest in connection with the present application is the Assignee of record, KOREA INSTITUTE OF SCIENCE AND TECHNOLOGY, 39-1, Hawolgok-Dong, Sungbook-Ku, Seoul 136-791, Republic of Korea.

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II. RELATED APPEALS AND INTERFERENCES

There are no pending Appeals or Interferences related to the present application known to the Appellants or the Appellants' Legal Representatives.

III. STATUS OF CLAIMS

Claims 1-23, 25, 26 and 28-36 are pending in the appealed application. Claims 24 and 27 have been canceled. Claims 2-19, 22 and 30-32 have been withdrawn from consideration by the Examiner. Claims 1, 20, 21, 23, 25, 26, 28, 29, 33 and 34 have been rejected. The Examiner has not indicated the allowability of claim 35.

IV. STATUS OF AMENDMENTS

An Amendment under 37 C.F.R. § 1.111 was filed on October 29, 2002, 2002. A Reply under 37 C.F.R. § 1.116 was filed on June 30, 2003, which was entered by a Request for Continued Examination (RCE) filed on September 2, 2003. A Reply under 37 C.F.R. § 1.111 was filed on May 25, 2004. In response to a final Office Action mailed September 21, 2004, an RCE accompanied by a Preliminary Amendment were filed on December 21, 2004. An Amendment under 37 C.F.R. § 1.111 was filed on June 14, 2005. An Amendment under 37 C.F.R. § 1.116 was filed on January 19, 2006, which was entered for purposes of appeal in the Advisory Action mailed February 14, 2006.

Accordingly, all amendments presented by the Appellants have been entered.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The present invention pertains to a method for surface processing by plasma polymerization of a surface of a metal by using a DC discharge plasma (page 4, lines 2-4). The method may include the steps of (a) positioning an anode electrode which is substantially of metal to be surface processed and a cathode electrode in a chamber (page 4, lines 4-6); (b) maintaining a pressure in the chamber at a predetermined vacuum level (page 4, lines 6-7); (c) blowing an unsaturated aliphatic hydrocarbon monomer gas or a fluorine-containing monomer gas at a predetermined pressure and a non-polymerizable gas at a predetermined pressure into the chamber (page 4, lines 7-9); and (d) applying a voltage to the electrodes for 5-60 seconds in order to obtain a DC plasma having positive and negative ions and radicals generated from the unsaturated aliphatic hydrocarbon monomer or the fluorine containing monomer gas and the non-polymerizable gas (page 4, lines 9-13; page 23, lines 19-24), and then forming a polymer with hydrophilicity or hydrophobicity on a surface of the anode electrode by plasma deposition (page 4, lines 13-15). In the invention, the polymer deposited at the anode electrode is stronger in adhesion strength between the polymer and the metal than a polymer deposited at the cathode electrode (page 11, lines 21-23), and the polymer obtained in the step (d) is surface-processed by a plasma of at least one non-polymerizable gas selected

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from O₂, N₂, CO₂, CO, H₂O and NH₃ gas (page 4, line 16) in order to improve the hydrophilicity of the polymer (page 4, lines 12-14).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The first issue presented for review is whether the combination of Cummin '830 (USP 3,252,830) in view of Yokoyama '971 (USP 5,080,971) sufficiently suggest each and every element of claims 1, 20, 21, 25, 26, 28, 33 and 34 to support a rejection under 35 U.S.C. §103(a).

The second issue presented for review is whether the combination of Cummin '830 in light of Yokoyama '971 and further in view of Yanagihara '799 (USP 4,693,799) sufficiently suggest each and every element of claim 23 to support a rejection under 35 U.S.C. §103(a).

The third issue presented for review is whether the combination of Cummin '830 in light of Yokoyama '971 and further in view of Kleeberg '290 (USP 5,089,290) sufficiently suggest each and every element of claim 29 to support a rejection under 35 U.S.C. §103(a).

VII. ARGUMENT

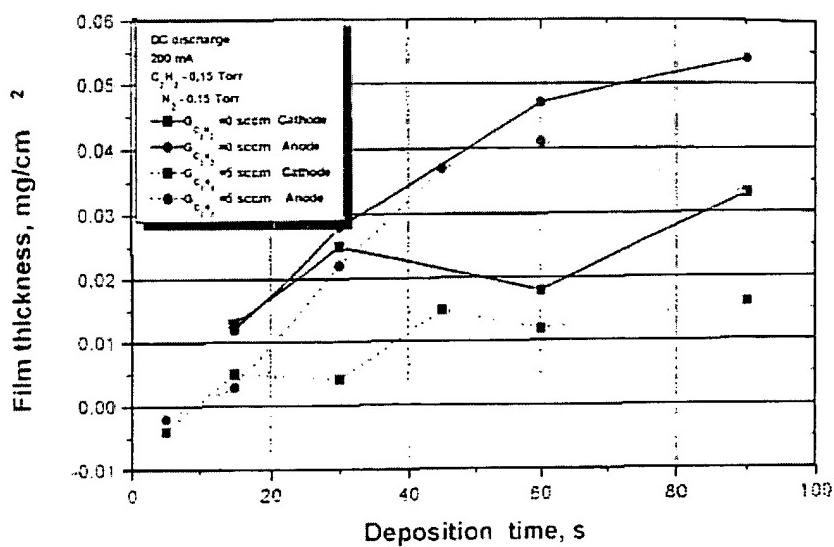
VII-A. The Present Invention and its Advantages

The present invention pertains to a method for surface processing by plasma polymerization of a surface of a metal by using a DC discharge plasma.

As set forth in claim 1 of the present invention, an optimal processing time is used where a voltage is applied to the electrodes for 5-60 seconds in order to obtain the DC discharge plasma.

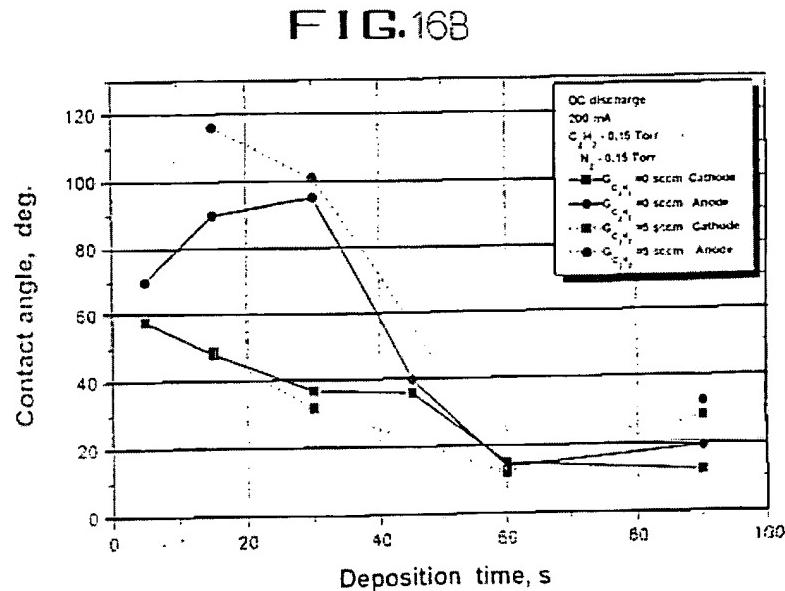
Among the unexpected results obtained by the present invention, one may note the relationship between film thickness and discharge time set forth in Fig. 16A, which is reproduced below.

FIG. 16A



As shown in Figure 16A, a polymeric coating is synthesized on the anode substrate over time and the thickness of the coating increases. However, after a time period of 60 seconds, the thickness of the coating no longer increases and instead decreases. As monomer gas continues to flow over the coating and reacts with remaining non-polymerizable gas, the thickness of the polymer synthesized on the substrate decreases. The attempt to polymerize the non-polymerizable gas and the additionally flowed monomer gas after the synthesis damages the previously formed polymer and thus reduces the thickness of the originally synthesized matter.

An additional unexpected result of the present invention is the variation of contact angle over time shown in Fig. 16B, which is reproduced below.



As shown in Figure 16B, the contact angle varies according to the processing time. The cathode and the anode have the lowest values at 60 seconds when the gaseous pressure reaches a minimum value. When the plasma discharge is performed for over 60 seconds, the polymer is worn due to the sputtering effect, which results in an increase in the contact angle properties.

As can be seen in Figs. 16A and 16B, when introducing monomer gas into the chamber during the discharge polymerization process, the thickness of the polymer increases, however the film thickness and contact angle properties deteriorate when the polymerization time is over 60 seconds.

VII-B. Distinctions of the Invention Over Cummin '830 and Yokoyama '971

When a rejection is based on 35 USC §103, what is in issue in such a rejection is "the invention as a whole," not just a few features of the claimed invention. Under 35 U.S.C. §103, "[a] patent may not be obtained . . . if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." The determination under §103 is whether the claimed invention as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. See *In re O'Farrell*,

853 F.2d 894, 902, 7 USPQ2d 1673, 1680 (Fed. Cir. 1988). In determining obviousness, the invention must be considered as a whole and the claims must be considered in their entirety. See *Medtronic, Inc. v. Cardiac Pacemakers, Inc.*, 721 F.2d 1563, 1567, 220 USPQ 97, 101 (Fed. Cir. 1983).

In rejecting claims under 35 USC 103, it is incumbent on the examiner to establish a factual basis to support the legal conclusion of obviousness. See *In re Fine*, 837 F.2d 1071, 1073, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In so doing, the examiner is expected to make the factual determinations set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), and to provide a reason why one of ordinary skill in the pertinent art would have been led to modify the prior art or to combine prior art references to arrive at the claimed invention. Such reasoning must stem from some teaching, suggestion or implication in the prior art as a whole or knowledge generally available to one having ordinary skill in the art. *Uniroyal Inc. v. F-Wiley Corp.*, 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed. Cir. 1988), *cert. denied*, 488 U.S. 825 (1988); *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 293, 227 USPQ 657, 664 (Fed. Cir. 1985), *cert. denied*, 475 U.S. 1017 (1986); *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). These showings by the examiner are an essential part of complying with the burden of presenting a *prima facie* case of obviousness. Note, *In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444

(Fed. Cir. 1992). The mere fact that the prior art may be modified in the manner suggested by the examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. *In re Fritch*, 972 F.2d 1260, 1266, 23 USPQ2d 1780, 1783-84 (Fed. Cir. 1992).

Further, the rigorous burden placed upon the Examiner for establishing *prima facie* obviousness has been emphasized by the United States Court of Appeals for the Federal Circuit in *In re Sang Su Lee*, 277 F.3d 1338, 61 USPQ2d 1430 (Fed. Cir. 2002). In *Sang Su Lee*, the court states:

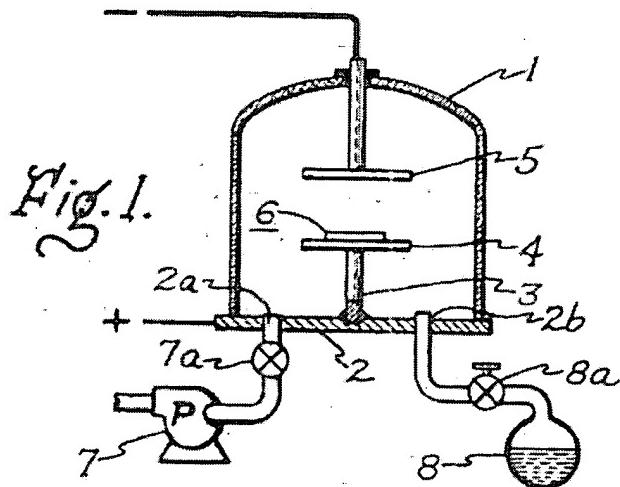
As applied to the determination of patentability *vel non* when the issue is obviousness, "it is fundamental that rejections under 35 U.S.C. §103 must be based on evidence comprehended by the language of that section." *In re Grasselli*, 713 F.2d 731, 739, 218 USPQ 769, 775 (Fed. Cir. 1983). The essential factual evidence on the issue of obviousness is set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17-18, 148 USPQ 459, 467 (1966) and extensive ensuing precedent. The patent examination process centers on prior art and the analysis thereof. When patentability turns on the question of obviousness, the search for and analysis of the prior art includes evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness. See, e.g., *McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 1351-52, 60 USPQ2d 1001, 1008 (Fed. Cir. 2001) ("the central question is whether there is reason to combine [the] references," a question of fact drawing on the *Graham* factors).

The need for specificity pervades this authority. See, e.g., *In re Kotzab*, 217 F.3d 1365, 1371, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) ("particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for

combination in the manner claimed"); *In re Rouffet*, 149 F.3d 1350, 1359, 47 USPQ2d 1453, 1459 (Fed. Cir. 1998) ("even when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill, that suggests the claimed combination. In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious."); *In re Fritch*, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992) (the examiner can satisfy the burden of showing obviousness of the combination "only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references"). *In re Sang Su Lee* at 277 F.3d 1342.

All of the references (including Cummin '830 and Yokoyama '971) relied upon for the above-noted rejections fail to disclose or suggest the plasma polymerization method time period range of 5-60 seconds as recited in step (d) of present claim 1. All of these references (including Cummin '830 and Yokoyama '971) fail to recognize the advantageously improved thickness and integrity of the polymeric coating when the appropriate time period is employed as in the method of the present invention.

Cummin '830 pertains to a method a making an electric capacitor as illustrated in Fig. 1, which is reproduced below.



In Cummin '830, a substrate sheet **6** including an electrical insulating material layer and a metallized layer is subjected to "glow discharge" conditions which include using DC current through electrodes **4** and **5** in a chamber **1** which is at least partially evacuated and into which a monomeric gas, such as an aliphatic unsaturated compound gas (e.g. acetylene). The aliphatic unsaturated compound gas is introduced optionally together with an inert carrier, such as nitrogen, as described at column 4. Cummin '830 at column 5, lines 68-74 and in Example II describes using an aluminum base plate.

Cummin '830 fails to disclose depositing a polymer through plasma polymerization on the surface of an anode electrode in a manner such as is described in claim 1 (and claim 36) of the present invention. Typically, Cummin '830 requires that the substrate sheet **6** include an electrical insulating material layer as described at column 4, lines 43-59. In addition,

Cummin '830 fails to disclose or suggest the 5-60 second time period feature of the present invention as discussed above.

At page 2, line 15 to page 3, line 1 of the final Office Action mailed August 19, 2005, the Examiner tacitly admits the failure of Cummin '830 to disclose adhesion by inferring inherency: "As to the adhesion property of the films, it is inherently possessed by the films when the substrate is the anode."

However, inherency need not bar patentability. Accidental results not intended and not appreciated do not constitute anticipation. *Eibel Processing Co. v. Minnesota and Ontario Paper Co.*, 261 US 45 (1923); *Mycogen Plant Science, Inc. v. Monsanto Co.*, 243 F.3d 1316, 1336, 5 USPQ2d 1030, 1053 (2001). Further, the Federal Circuit stated in *In re Robertson*, that "to establish inherency, extrinsic evidence must make clear that the missing descriptive matter was necessarily present in the thing described in the reference, and would be so recognized by persons with ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a set of circumstances is not sufficient." *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949 (Fed. Cir. 1999). Further, it has been held that the mere fact that a certain thing may result from a given set of circumstances is not sufficient, and occasional results are not inherent. *MEHL/Biophile International v. Milgram*, 192 F.3d 1362, 1365, 52 USPQ2d 1303 (Fed. Cir. 1999).

In this case, Cummin '830 uses a metallized polymer film as a substrate since it is convenient to incorporate the filmed substrate as part of a capacitor (see Cummin '803 at column 4, lines 43-45). The initial layer on the polymer film is an electrode of a capacitor. A second electrode is provided after the dielectric film is deposited on the substrate. In view of this process, it is clear that the metal layer on the substrate is used as an electrode and is not used to overcome an adhesion problem.

Furthermore, Cummin '830 fails to teach a post process for improving the hydrophilic property of the surface of the substrate. As is set forth in claim 1 of the present invention, the polymer "is surface-processed by a plasma of at least one non-polymerizable gas selected from the group consisting of O₂, N₂, CO₂, CO, H₂O and NH₃ gas in order to improve the hydrophilicity of the polymer" (see claim 1 of the present invention).

Yokoyama '971 discloses a process for making a magnetic recording medium that employs plasma polymerization. For a discussion of plasma polymerization, at page 3, lines 2-3 of the final Office Action mailed August 19, 2005 the Examiner turns to the discussion at column 4, lines 18-44 of Yokoyama '971:

The principle of plasma polymerization will be briefly described. When an electric field is applied to a gas kept at a reduced pressure, free electrons which are present in a minor proportion in the gas and have a remarkably greater inter-molecular distance than under atmospheric pressure are accelerated under the electric field to gain a kinetic energy (electron temperature) of 5 to

10 eV. These accelerated electrons collide against atoms and molecules to fracture their atomic and molecular orbitals to thereby dissociate them into normally unstable chemical species such as electrons, ions, neutral radicals, etc. The dissociated electrons are again accelerated under the electric field to dissociate further atoms and molecules. This chain reaction causes the gas to be instantaneously converted into highly ionized state. This is generally called a plasma. Since gaseous molecules have a less chance of collision with electrons and absorb little energy, they are kept at a temperature approximate to room temperature. Such a system in which the kinetic energy (electron temperature) of electrons and the thermal motion (gas temperature) of molecules are not correlated is designated a low temperature plasma. In this system, chemical species set up the state capable of additive chemical reaction such as polymerization while being kept relatively unchanged from the original.

However, the technology of Yokoyama '571 can be better understood by referring to Figure 1 of the patent, which is reproduced below.

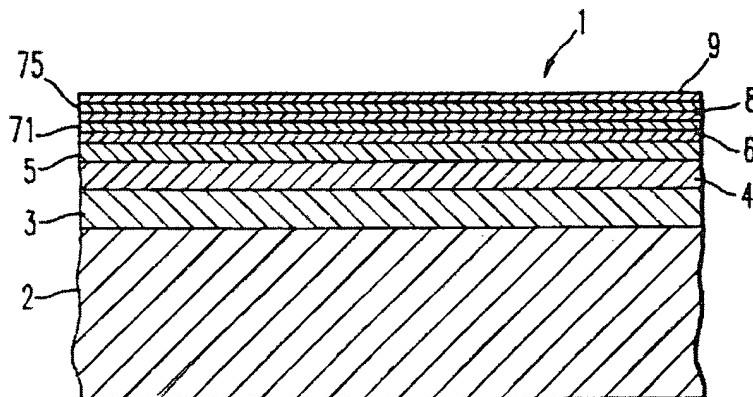


FIG. 1

In Figure 1 of Yokoyama '971, it appears that the substrate upon which the polymer is deposited through plasma polymerization includes all of a first substrate **2** of a non-magnetic material, an undercoat layer **3** which is

preferably a nickel alloy, a non-magnetic intermediate layer **4**, an intermediate magnetic layer **5**, a protective non-magnetic metal film **6** preferably of chromium, and finally a topcoat layer **9** which is the plasma-polymerized film.

See Yokoyama at column 3, lines 22-33.

As a result, Yokoyama '971 fails to disclose the employment of the substrate that is plasma-polymerized as an anode electrode as in the present invention. In addition, Yokoyama '971 fails to disclose or suggest the time period feature of the present invention as discussed above.

At page 3, lines 6-12 of the final Office Action mailed August 19, 2005, the Examiner admits to at least some of the failings of Cummin '830 and Yokoyama '971 but insists that the missing subject matter can be obtained via optimization:

The difference between Cummin and the above claims is the recited period of applying the voltage. Because Cummin teaches the film thickness of less than 0.5 micron, the subject matter as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified Cummin's teachings in light of Yokoyama as it has been settled that proper adjustment of a known effect variable of a known or obvious process is within the capabilities of one having ordinary skill in the art.

However, as was discussed above, the time period of applying voltage is an unexpected result and not a result-effective variable. In general, a polymer is synthesized on the substrate with the lapse of a certain time and thus the thickness of the polymer increases. However, the inventors of the present

invention have unexpectedly found that after 60 seconds, the thickness of the polymer no longer increases and instead it is reduced (see Fig. 16A, reproduced above). It has also been found that when monomer gas continues to flow to the synthesized substrate and is reacted with remaining non-polymerizable gas, the thickness of the polymer synthesized on the substrate is reduced.

Moreover, as shown in Fig 16B (reproduced above), the contact angle varies according to the processing time. The cathode and the anode have the lowest values at 60 seconds at which the gas pressure has a minimum value. When the plasma discharge is preformed for over 60 seconds, the polymer degrades due to a sputtering effect, which results in an increase in the contact angle.

As can be seen in Figs. 16A and 16B, when introducing monomer gas into the chamber during the discharge polymerization process, the thickness of the polymer increases. However, the contact angle decreases when the polymerization time is over 60 seconds.

At page 2 of the Advisory Action of February 14, 2006, the Examiner re-asserts his position of result-effective optimization:

As to unexpected results to optimal time of 5-60 seconds as pointed out by Applicant as shown in Figs. 16A and 16B, the unexpexted [sic] results are applied in the case when the partial pressure of each gas is held at 0.15 Torr and the DC discharge voltage is at 200 mA. The optimal time is a function for the partial pressure of each gas and the DC discharge current and will be varied accordingly.

However, the relationships in Figures 16A and 16B of the present invention are non-linear in nature. For example, when C₂H₂ is used at 5 sccm Anode in Figure 16B, a maximum is observed before the contact angle reaches a minimum level at 60 seconds. One of ordinary skill would not be motivated to continue experimenting after the contact angle approaches 100 degrees at a lower deposition time. As a result, it cannot be assumed that an optimal result would be attained at 0.15 Torr and a DC discharge voltage of 200 mA.

As a result, one of ordinary skill in the art would not be motivated by Cummin '830 and Yokoyama '971 to produce a claimed embodiment of the present invention. A *prima facie* case of obviousness has not been made over claim 1 (or claim 36). Claims depending upon claim 1 are patentable for at least the above reasons. Even if obviousness could be inferred, this obviousness would be fully rebutted by the unexpected results typified by Figs. 16A and 16B of the application.

VII-C. Distinctions Of The Invention Over Cummin '830, Yokoyama '971

and Yanagihara '799

The failures of Cummin '830 and Yokoyama '971 in disclosing or suggesting a claimed embodiment of the present invention have been discussed above. The Examiner turns to Yanagihara '799 for teachings pertaining to periodicity of DC discharge to reject claim 23. However, these teachings of

Yanagihara '799 fail to address the deficiencies in teaching or suggesting a claimed embodiment of the present invention. A *prima facie* case of obviousness has not been made over claim 23. Also, the invention shows unexpected results over claim 23 (as were typically discussed above).

VII-D. Distinctions Of The Invention Over Cummin '830, Yokoyama '971

and Kleeberg '290

The failures of Cummin '830 and Yokoyama '971 in disclosing or suggesting a claimed embodiment of the present invention have been discussed above. The Examiner turns to Kleeberg '290 for teachings pertaining to annealing. However, these teachings of Kleeberg '290 fail to address the deficiencies in teaching or suggesting a claimed embodiment of the present invention. A *prima facie* case of obviousness has not been made over claim 23. Also, the invention shows unexpected results over claim 23 (as were typically discussed above).

VII-E. Summary

The inventive method for surface processing by plasma polymerization obtains truly novel and unexpected results. As has been shown, the Examiner has failed to establish that Cummin '830 and Yokoyama '971 render the present invention *prima facie* obvious. The teachings of Yanagihara '799 and Kleeberg '290 fail to address the deficiencies of Cummin '830 and Yokoyama '971. The present invention additionally shows unexpected results over any obviousness that can be alleged.

Accordingly, reversal of the Examiner's rejections of claims 1, 20, 21, 23, 25, 26, 28, 29, 33 and 34 based on the above arguments is respectfully requested.

CONCLUSION

The Appellants have demonstrated that the Examiner has failed to successfully allege that the rejected claims are *prima facie* obvious. It is clear that the inventive liquid crystal display device represents a truly inventive display technology. For the reasons advanced above, it is respectfully submitted that all claims in this application are allowable. Thus, favorable reconsideration and reversal of the Examiner's rejections of claims 1, 20, 21, 23, 25, 26, 28, 29, 33 and 34 under 35 U.S.C. §103(a), by the Honorable Board of Patent Appeals and Interferences, are respectfully solicited.

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The required Appeal Brief fee in the amount of \$500.00 is attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and further replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fee required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

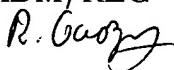
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Attachments: VIII CLAIMS APPENDIX
IX EVIDENCE APPENDIX
X RELATED PROCEEDINGS APPENDIX

VIII

CLAIMS APPENDIX

1. (Previously Presented) A method for surface processing by plasma polymerization of a surface of a metal by using a DC discharge plasma, comprising the steps of:
 - (a) positioning an anode electrode which is substantially of metal to be surface processed and a cathode electrode in a chamber;
 - (b) maintaining a pressure in the chamber at a predetermined vacuum level;
 - (c) blowing an unsaturated aliphatic hydrocarbon monomer gas or a fluorine-containing monomer gas at a predetermined pressure and a non-polymerizable gas at a predetermined pressure into the chamber; and
 - (d) applying a voltage to the electrodes for 5-60 seconds in order to obtain a DC plasma consisting of positive and negative ions and radicals generated from the unsaturated aliphatic hydrocarbon monomer or the fluorine containing monomer gas and the non-polymerizable gas, and then forming a polymer with hydrophilicity or hydrophobicity on a surface of the anode electrode by plasma deposition, wherein said polymer deposited at the anode electrode is stronger in adhesion strength between the polymer and the

metal than a polymer deposited at the cathode electrode, wherein the polymer obtained in the step (d) is surface-processed by a plasma of at least one non-polymerizable gas selected from the group consisting of O₂, N₂, CO₂, CO, H₂O and NH₃ gas in order to improve the hydrophilicity of the polymer.

2. (Withdrawn) A method for surface processing by plasma polymerization of a surface of an insulating material such as polymer or ceramic material by using a DC discharge plasma, comprising:

- (a) positioning a metallic anode electrode and a cathode electrode in a chamber, wherein the insulating material to be surface-processed is positioned closely proximate to a surface of the metallic anode electrode;
- (b) maintaining a pressure in the chamber at a predetermined vacuum level;
- (c) blowing an unsaturated aliphatic hydrocarbon monomer gas or a fluorine-containing monomer gas at a predetermined pressure and a non-polymerizable gas at a predetermined pressure into the chamber; and
- (d) applying a voltage to the electrodes in order to obtain a DC discharge, whereby to obtain a plasma consisting of positive

and negative ions and radicals generated from the unsaturated aliphatic hydrocarbon monomer gas or the fluorine containing monomer gas and the non-polymerizable gas, and then forming a polymer with hydrophilicity or hydrophobicity on the surface of the insulating material proximate the anode electrode by plasma deposition.

3. (Withdrawn) The method for surface processing by plasma polymerization according to claim 2, wherein the DC discharge is performed periodically in the form of on/off pulsing during a total processing time in order to improve the hydrophilicity of the polymer.

4. (Withdrawn) The method for surface processing by plasma polymerization according to claim 2, wherein the polymer obtained in the step (d) is surface-processed by a plasma of at least one non-polymerizable gas selected from a group consisting of O₂, N₂, CO₂, CO, H₂O and NH₃ gas in order to improve the hydrophilicity of the polymer.

5. (Withdrawn) The method for surface processing by plasma polymerization according to claim 4, wherein the nonpolymerizable gas is used with an inert gas.

6. (Withdrawn) The method for surface processing by plasma polymerization according to claim 4, wherein in the additional plasma processing, the electrode or insulating material on which the polymer is deposited in the step (d) is used as a cathode.

7. (Withdrawn) The method for surface processing by plasma polymerization according to claim 2, wherein in the step (d), the polymerization process by the plasma is performed for 1sec – 2min.

8. (Withdrawn) The method for surface processing by plasma polymerization according to claim 7, wherein in the step (d), the polymerization process by the plasma is performed for 5sec – 60sec.

9. (Withdrawn) The method for surface processing by plasma polymerization according to claim 2, wherein the ratio of the unsaturated aliphatic hydrocarbon monomer gas and the non-polymerizable gas is varied whereby to vary the properties of the polymer.

10. (Withdrawn) The method for surface processing by plasma polymerization according to claim 2, wherein the ratio of the fluorine-

containing monomer gas and the non-polymerizable gas is varied whereby to vary the properties of the polymer.

11. (Withdrawn) The method for surface processing by plasma polymerization according to claim 10, wherein the fluorine-containing monomer gas comprises a monomer gas consisting of C, H and F such as C₂H₂F₂, C₂HF₃ and containing at least one carbon double bond.

12. (Withdrawn) The method for surface processing by plasma polymerization according to claim 2, wherein the non-polymerizable gas is 0-90% of the whole gas mixture.

13. (Withdrawn) The method for surface processing by plasma polymerization according to claim 2, wherein the polymer is annealed at a temperature of 100 - 400°C in the ambient atmosphere for 1 - 60min.

14. (Withdrawn) A method for surface processing by plasma polymerization of a surface of a materials including a metal, a ceramic or a polymer by using an RF discharge plasma, comprising the steps of:

- (a) positioning a passive electrode which is of the material to be surface-processed and an active electrode which is

- substantially of metal in a chamber;
- (b) maintaining a pressure in the chamber at a predetermined vacuum level;
- (c) blowing an unsaturated aliphatic hydrocarbon monomer gas or a fluorine-containing monomer gas at a predetermined pressure and a nonpolymerizable gas at a predetermined pressure into the chamber; and
- (d) applying a voltage to the electrodes in order to obtain an RF discharge, whereby to obtain a plasma consisting of positive and negative ions and radicals generated from the unsaturated aliphatic hydrocarbon monomer gas or the fluorine containing monomer gas and the non-polymerizable gas, and then forming a polymer with hydrophilicity or hydrophobicity on the surface of the passive electrode by plasma deposition.

15. (Withdrawn) The method for surface processing by plasma polymerization according to claim 14, wherein properties of the polymer are determined by the ratio of the unsaturated aliphatic hydrocarbon monomer gas and the nonpolymerizable gas.

16. (Withdrawn) The method for surface processing by plasma polymerization according to claim 14, wherein properties of the polymer are determined by the ratio of the fluorine-containing monomer gas and the non-polymerizable gas.

17. (Withdrawn) The method for surface processing by plasma polymerization according to claim 16, wherein the fluorine-containing monomer gas comprises a monomer gas consisting of C, H and F such as C₂H₂F₂, C₂HF₃ and containing at least one double bonding of carbon.

18. (Withdrawn) The method for surface processing by plasma polymerization according to claim 14, wherein the polymer is annealed at a temperature of 100 - 400°C in the ambient atmosphere for 1 – 60min.

19. (Withdrawn) A method for surface processing by plasma polymerization of a surface of materials including a metal, a ceramic or a polymer by using an RF discharge plasma, comprising the steps of:

- (a) positioning an active electrode which is of the materials to be surface-processed and a passive electrode which is substantially of metal in a chamber;
- (b) maintaining a pressure in the chamber at a predetermined

vacuum level;

- (c) blowing a fluorine-containing monomer gas at a predetermined pressure and a non-polymerizable gas at a predetermined pressure into the chamber; and
- (d) applying a voltage to the electrodes in order to obtain an RF discharge, whereby to obtain a plasma consisting of positive and negative ions and radicals generated from the fluorine containing monomer gas and the non-polymerizable gas, and then forming a polymer with hydrophobicity on the surface of the active electrode by plasma deposition.

20. (Previously Presented) A material having a polymer with excellent hydrophilicity or hydrophobicity fabricated by the method of claim 1.

21. (Original) The material according to claim 20, wherein the material surface has a polymer which exhibits an excellent affinity for paint.

22. (Withdrawn) The material according to claim 14, wherein the material surface has a polymer which exhibits excellent corrosion-resistance.

23. (Previously Presented) The method for surface processing by

plasma polymerization according to claim 1, wherein the DC discharge is performed periodically in the form of on/off pulsing during a total processing time.

24. (Canceled)

25. (Previously Presented) The method for surface processing by plasma polymerization according to claim 1, wherein the step (d), the polymerization process by the plasma is performed for 1 sec - 2 min.

26. (Previously Presented) The method for surface processing by plasma polymerization according to claim 1, wherein the ratio of the unsaturated aliphatic hydrocarbon monomer gas and the non-polymerizable gas is varied to vary the properties of the polymer.

27. (Canceled)

28. (Previously Presented) The method for surface processing by plasma polymerization according to claim 1, wherein the non-polymerizable gas is 0-90% of the whole gas mixture.

29. (Previously Presented) The method for surface processing by plasma polymerization according to claim 1, wherein the polymer is annealed at a temperature of 100-400°C in the ambient atmosphere for 1 – 60 min.

30. (Withdrawn) A material having a polymer with excellent hydrophilicity or hydrophobicity is fabricated by the method of claim 2.

31. (Withdrawn) A material having a polymer with excellent hydrophilicity or hydrophobicity is fabricated by the method of claim 14.

32. (Withdrawn) A material having a polymer with excellent hydrophilicity or hydrophobicity is fabricated by the method of claim 19.

33. (Previously Presented) The method for surface processing by plasma polymerization according to claim 1, wherein the unsaturated aliphatic hydrocarbon monomer gas is used.

34. (Previously Presented) The method for surface processing by plasma polymerization according to claim 1, wherein the unsaturated aliphatic hydrocarbon monomer gas is used and is acetylene.

35. (Previously Presented) The method for surface processing by plasma polymerization according to claim 1, wherein the anode electrode is formed entirely of metal.

36 (Previously Presented) A method for surface processing by plasma polymerization of a surface of a metal by using a DC discharge plasma, comprising the steps of:

positioning an anode electrode which is substantially of metal to be surface processed and a cathode electrode in a chamber;

maintaining a pressure in the chamber at a predetermined vacuum level;

blowing an unsaturated aliphatic hydrocarbon monomer gas or a fluorine-containing monomer gas at a predetermined pressure and a non-polymerizable gas at a predetermined pressure into the chamber;

applying a voltage to the electrodes for 5-60 seconds in order to obtain a DC plasma consisting of positive and negative ions and radicals generated from the unsaturated aliphatic hydrocarbon monomer or the fluorine containing monomer gas and the non-polymerizable gas, the DC discharge being performed periodically in a form of on/off pulsing during a total processing time;

forming a polymer with hydrophilicity or hydrophobicity on a surface of the anode electrode by plasma deposition, wherein said polymer deposited at

the anode electrode is stronger in adhesion strength between the polymer and the metal than a polymer deposited at the cathode electrode; and annealing the polymer at a temperature of 100-4000 °C in an ambient atmosphere for 1-60 min.

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IX

EVIDENCE APPENDIX

(Not Applicable)

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X

RELATED PROCEEDINGS APPENDIX

(Not Applicable)